

## PLAGUE

### Bioterrorism Agent Profiles for Health Care Workers

**Causative Agent:** Gram-negative bacillus *Yersinia pestis*.

**Routes of Exposure:** Inhalation, fleabite, and direct contact with infected blood and tissues.

**Infective Dose & Infectivity:** 10-500 organisms

**Incubation Period:** The incubation period for pulmonary exposure ranges from 1 to 6 days with an average of 2-4 days.

**Clinical Effects:** Onset of pneumonic plague is acute and often fulminant. The presentation includes high fever, cough, chest pain, malaise, hemoptysis, and muco-purulent or watery sputum with gram-negative rods on gram stain. Patients commonly show evidence of bronchopneumonia. The pneumonia progresses rapidly, resulting in dyspnea, stridor and cyanosis. Gastrointestinal symptoms including nausea, vomiting, diarrhea and abdominal pain might also be present. Buboes (regional lymphadenopathy) are rarely seen. Other advanced signs of pneumonic plague include respiratory failure, circulatory collapse, and bleeding diathesis.

**Lethality:** The mortality rate of untreated pneumonic plague usually is 90-100%. However, with prompt appropriate treatment, the mortality rate drops to 5% or less.

**Transmissibility (person to person):** Person-to-person transmission occurs via respiratory droplets.

**Primary Contamination & Methods of Dissemination:** Dissemination of plague as a biological weapon would most likely be through aerosolization.

**Secondary Contamination & Persistence of organism:** *Y. pestis* is very sensitive to sunlight and heat and does not survive long outside of the host. Therefore, secondary contamination is not a concern.

**Decontamination & Isolation:**

*Patients* – Patients with suspected pneumonic plague should be managed with droplet precautions. Plague patients without pneumonia require only standard precautions. Drainage from buboes should be considered infectious and treated with appropriate personal protective equipment (e.g. gloves when touching drainage, gowns if clothes could be contaminated).

*Equipment & other objects* – Environmental decontamination can be done using a 0.5% hypochlorite solution (1 part household bleach + 9 parts water = 0.5% solution), prior to normal cleaning or washing.

*Outbreak control* – All patients with pneumonic plague should be in droplet isolation for the first 48 hours after the initiation of treatment. This means that a healthcare worker should use a surgical mask within 3 feet of the patient. Those who have been in household or face-to-face contact with patients with pneumonic plague should be given antibiotic prophylaxis and placed under fever surveillance for 7 days.

**Laboratory Testing:** A presumptive diagnosis can be made microscopically by identification of the gram-negative coccobacillus with safety-pin bipolar staining in Gram or Wayson's stained smears from peripheral blood, sputum, or cerebrospinal fluids sample. When available, immunofluorescent staining is very useful.

1. Cultures of blood, sputum, buboes, and CSF, should be processed on blood agar, MacConkey agar or infusion broth. The organism grows slowly at normal incubation temperatures, and may be misidentified by automated systems because of delayed biochemical reactions. Confirmation of organism is done by DFA, phage typing, and/or PCR.
2. Antibody response test: A four-fold rise in antibody titer by ELISA or passive hemagglutination in patient serum is also diagnostic.

**Therapeutic Treatment:** Historically, the treatment of choice for bubonic, septicemic, and pneumonic plague has been streptomycin. However, since streptomycin is no longer readily available, gentamicin appears just as effective. Doxycycline or ciprofloxacin\* are alternative antibiotics. Once the patient is stable, an effective oral antibiotic can be used to complete the course of therapy. IV chloramphenicol is the drug of choice for plague meningitis.

**Prophylactic Treatment:** Because of oral administration and relative lack of toxicity, the antibiotic for prophylaxis or for use in face-to-face contacts of patients with pneumonic plague is doxycycline.

**Differential diagnosis:** For pneumonic plague the differential diagnoses should include any acute pneumonia, tularemia, hantavirus pulmonary syndrome, and anthrax.

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For more information call (602) 364-3289

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\* Ciprofloxacin does not have an FDA approved indication for treatment of plague

## Frequently Asked Questions About Plague

### What is plague?

Plague is a disease caused by *Yersinia pestis* (*Y. pestis*), a bacterium found in rodents and their fleas in many areas around the world.

### Why are we concerned about pneumonic plague as a biological weapon?

*Yersinia pestis* used in an aerosol attack could cause cases of the pneumonic form of plague. One to six days after becoming infected with the bacteria, people would develop pneumonic plague. Once people have plague pneumonia, the bacteria can spread to others who have close contact with them. Because of the delay between being exposed to the bacteria and becoming sick, people could travel a long distance before then becoming contagious and possibly infecting others. Controlling the disease would then be more difficult. A biological weapon that spreads *Y. pestis* is possible because the bacterium occurs in nature and could be isolated and grown in quantity in a laboratory. Even so, manufacturing an effective weapon using *Y. pestis* would require advanced knowledge and technology.

### Is pneumonic plague different from bubonic plague?

Yes. Both are caused by *Yersinia pestis*, but they are transmitted differently and their symptoms differ. Pneumonic plague can be transmitted directly from person-to-person by coughing. Bubonic plague is hardly ever spread person to person. Pneumonic plague affects the lungs and is transmitted when a person breathes in *Y. pestis* particles in the air. Bubonic plague is transmitted through the bite of an infected flea or exposure to infected material through a break in the skin. Symptoms include swollen, tender lymph glands called buboes. If bubonic plague is not treated, however, the bacteria can spread through the bloodstream and infect the lungs, causing a secondary case of pneumonic plague.

### What are the signs and symptoms of pneumonic plague?

Patients usually have fever, weakness, and rapidly developing pneumonia with shortness of breath, chest pain, cough, and sometimes bloody or watery sputum. Nausea, vomiting, and abdominal pain may also occur. Without early treatment, pneumonic plague usually leads to respiratory failure, shock, and rapid death.

### How do people become infected with pneumonic plague?

Pneumonic plague occurs when *Yersinia pestis* infects the lungs. Transmission can take place if someone breathes in *Y. pestis* particles, which could happen in an aerosol release during a bioterrorism attack. Pneumonic plague is also transmitted by breathing in *Y. pestis* suspended in respiratory droplets from a person (or animal) with pneumonic plague. Respiratory droplets are spread most readily by coughing or sneezing. Becoming infected in this way usually requires direct and close (within 6 feet) contact with the ill person or animal. Pneumonic plague may also occur if a person with bubonic or septicemic plague is untreated and the bacteria spread to the lungs.

**Does plague occur naturally in the United States and in Arizona?**

Yes. Today, plague remains a naturally occurring infection of rats, ground squirrels, prairie dogs, and other rodents on every populated continent except Australia. In the U.S. plague is most common in the southwestern states, particularly New Mexico and Arizona. An average of 1 to 2 cases of human plague occur naturally each year in Arizona. Most cases are seen in the northwest portion of the state, although cases can likely occur anywhere in the state above 4000 feet of elevation.

**Can a person exposed to pneumonic plague avoid becoming sick?**

Yes. People who have had close contact with an infected person can greatly reduce the chance of becoming sick if they begin treatment within 7 days of their exposure. Treatment consists of taking antibiotics for at least 7 days.

**How quickly would someone get sick if exposed to plague bacteria through the air?**

Someone exposed to *Yersinia pestis* through the air—either from an intentional aerosol release or from close and direct exposure to someone with plague pneumonia—would become ill within 1 to 6 days.

**Can pneumonic plague be treated?**

Yes. Several types of antibiotics are effective for curing the disease, and also for preventing it. Available oral medications are a tetracycline (such as doxycycline) or a fluoroquinolone (such as ciprofloxacin). For injection or intravenous use, streptomycin or gentamicin antibiotics are used.

**Would enough medication be available in the event of a bioterrorism attack involving pneumonic plague?**

National and state public health officials have large supplies of drugs needed in the event of a bioterrorism attack. These supplies can be sent anywhere in the United States within 12 hours.

**What should someone do if they suspect they or others have been exposed to plague?**

Get immediate medical attention. A person who has been exposed to pneumonic plague should rapidly receive antibiotics to prevent illness. Local or state health departments should be notified of the possibility of a patient with plague. They will then immediately investigate to determine whether the illness were due to naturally occurring disease.

**How can someone reduce the risk of getting pneumonic plague from another person or giving it to someone else?**

People having direct and close contact with someone with pneumonic plague should wear disposable surgical masks. Patients with the disease should be isolated and medically supervised for at least the first 48 hours of antibiotic treatment. People who have been exposed to a contagious person can be protected from developing plague by receiving prompt antibiotic treatment.

**How is plague diagnosed?**

The first step is receiving an evaluation by a health worker. If the health worker suspects pneumonic plague, samples of the patient's blood, sputum, or lymph node aspirate are sent to a laboratory for testing. Some preliminary laboratory results can be available in just a few hours, though more definite results usually take several days.

**Frequently Asked Questions About Plague**  
(continued from previous page)

**How long can plague bacteria exist in the environment?**

*Yersinia pestis* is easily destroyed by sunlight and drying. Even so, when released into air, the bacterium will survive for up to one hour, depending on conditions.

**Is a vaccine available to prevent pneumonic plague?**

Currently, no plague vaccine is available in the United States. Research is in progress, but we are not likely to have vaccines for several years or more.

For more information call (602) 364-3289